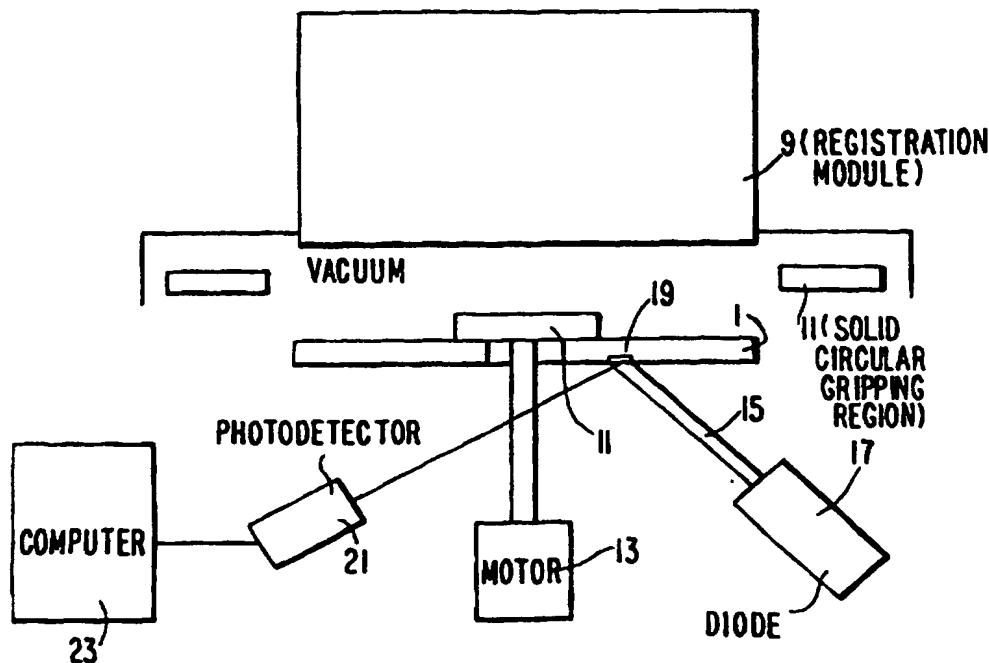




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(54) Title: PRINT-REGISTRATION INDEXING DEVICE



(57) Abstract

An apparatus for removing an optical disc (2) from a printing conveyor (5), storing it off-line for an indefinite length of time, and returning it to the printing line at some reference angular orientation. A theoretically endless number of ink passes may be applied to an optical disc as a result of this device. Such a task may be achieved even with a printer possessing a small number of print heads.

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PRINT-REGISTRATION INDEXING DEVICEField Of The Invention

This invention relates to the assembly line printing of information on compact discs during their manufacture in an on-line process. In particular it relates to printing registration to enable multiple color printing stages.

Background Of The Invention

Compact discs are optical recording media that are read by a laser through one transparent surface of the disc. The optical data are pits that are too small to be seen by unaided eye, although they cause some diffraction that is visible. The data is recorded in a spiral from the inside outwardly, beginning a certain distance from a central hole in the disc. For identification purposes visible text is made to appear around the circumference of the central hole at a radius less than the start radius for the optical data.

Typically, compact discs have information printed on the surface that is not required to be transparent to a reading laser. The printing method usually employed is screen printing. Printing is usually accomplished by multiple print heads and/or multiple passes through the printing station of an assembly line.

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Brief Description Of The Invention

The Print-Registration Indexing Device provides the means for removing an optical disc from a printing line, placing it in a storage buffer, and then returning 5 it to the printing line in the exact angular orientation that it originally possessed prior to its first removal from the printing line. Such steps may be repeated an endless number of times. Usage of such a device allows an optical disc printer to apply a theoretically endless 10 number of ink passes to a disc, while using a printer with a small number of printing heads.

Brief Description Of The Drawings

Figure 1 is a side cutaway view of the spindle and robot of the invention.

15 Figure 2 is a top view of the printer machine conveyer of the invention.

Figure 3 is side view of the present invention.

Figure 4 is top view of a disc having an identification band.

20 Detailed Description Of A Preferred Embodiment

The purpose of the Print Registration Indexing Device is to allow a printer with any number of print heads to apply an unlimited amount of ink patterns to an

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optical disc, where the disc is removed from the printer's conveyor in between printer passes and returned to the printer with its previous angular orientation.

The registration task is achieved as follows.

5 Optical discs 1 stacked on spindles 3 are placed on the printer machine conveyor 5 by means of a robot arm 7. The angular orientation of these discs is truly random, in that the standard identification markings in the identification band of the disc reside at differing
10 angles when comparing disc to disc. A few positions away from the entrance to the conveyor exists the registration module 9, a mechanical assembly which provides the actual registration of each disc. As discs pass under the registration module, a vacuum lifts the disc
15 approximately one centimeter upward such that the disc becomes attached to a solid circular gripping region 11.

With the vacuum remaining intact, a steppe motor 13 soon activates to spin the optical disc at a constant velocity. during the spin, a beam of light 15
20 originating from a laser diode 17 strikes the identification band 19 of the disc. The reflected light reaches a photodetector 21, whose electrical output is sent to a computer 23 for analysis.

At the computer, an algorithm analyzes the
25 electrical output of the photodetector. Since the

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identification band 19 of the optical disc is annular in shape, an endless circular array of data must be analyzed. The algorithm sets a reference point in the identification band where the stepper motor is given a 5 signal to stop rotating. A minimum of two rotations is required so that the laser diode beam passes through the entire identification band with no breaks at the endpoints of the identification band. Each optical disc at the registration module will stop at the same 10 reference point, affording an identical registration for each disc in the production run.

Once the stepper motor 13 stops at the reference position, the registration module places the disc back on the printer conveyor, where the vacuum 25 of 15 the printer conveyor resumes its grip on the disc, holding it in place on the conveyor during printing until the exit robot 27 removes the disc from the line. This process can be run continuously for as many printer passes as the particular artwork requires.

20 While there have been shown and described and pointed out the fundamental novel features of the invention as applied to preferred embodiments thereof, it will be understood that various omissions and substitutions and changes in the form and details of the

device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention, which is expressed in the following claims.

I claim:

1. A method for removing an optical disc having an annular identification band from a printing line, and then returning it to the printing line in the angular orientation that it originally possessed prior to its first removal from the printing line comprising

5 (a) rotating said disc through at least two rotations under control of a stepping motor, wherein a predetermined location on the 10 identification band is recognized,

(b) stopping the stepping motor, wherein the predetermined location on the identification band has said angular orientation, and

15 (c) returning said disc to the printing line with said identification band having said annular orientation.

2. The method for removing an optical disc from a printing line and then returning it to the printing line in the exact angular orientation that it originally possessed prior to its first removal from the printing line comprising

20 placing optical discs on a printer machine conveyor by means of a robot arm,

25 passing a disc a registration module, wherein a vacuum lifts the disc,

attaching the disc to a solid circular gripping region,

activating a steppe motor to spin the optical disc at a constant velocity,

5 illuminating the identification band of the disc with a beam of light originating from a laser diode, wherein the reflected light reaches a photodetector,

setting a reference point in the identification band where the stepper motor is given a signal to stop rotating,

10 placing the disc back on the printer conveyor,

holding the disc in place on the conveyor during printing, and removing the disc from the line.

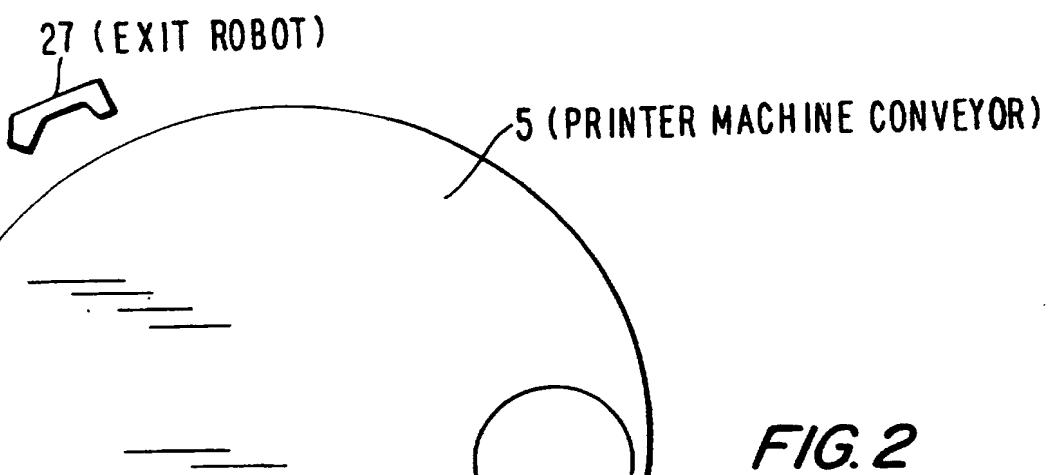
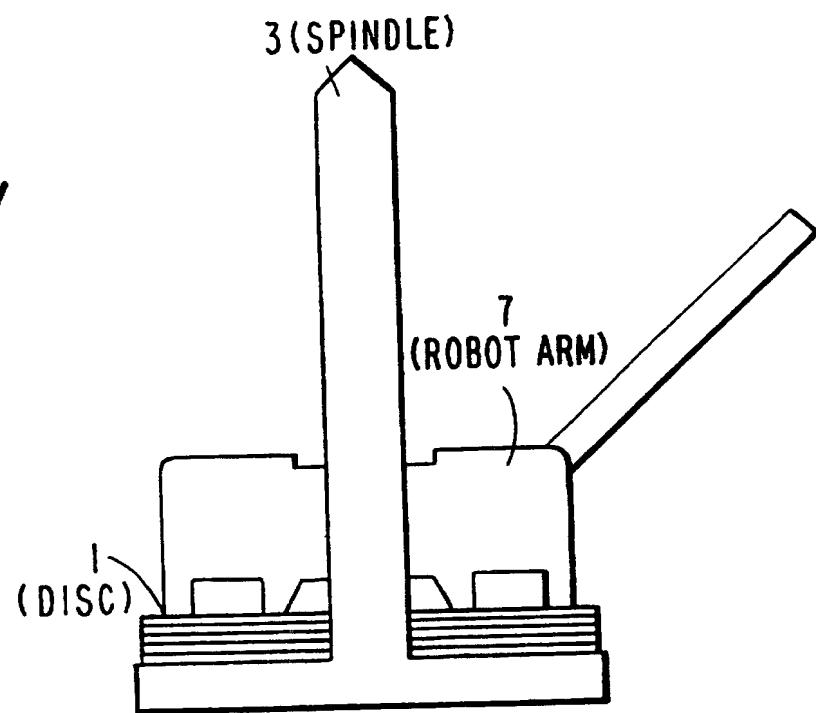
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3. The method for removing an optical disc from a printing line and then returning it to the printing line of claim 2 wherein the disc is rotated through at least two rotations.

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4. The method of claim 3 run continuously for as many printer passes as a particular artwork requires.

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FIG.1*FIG.2*

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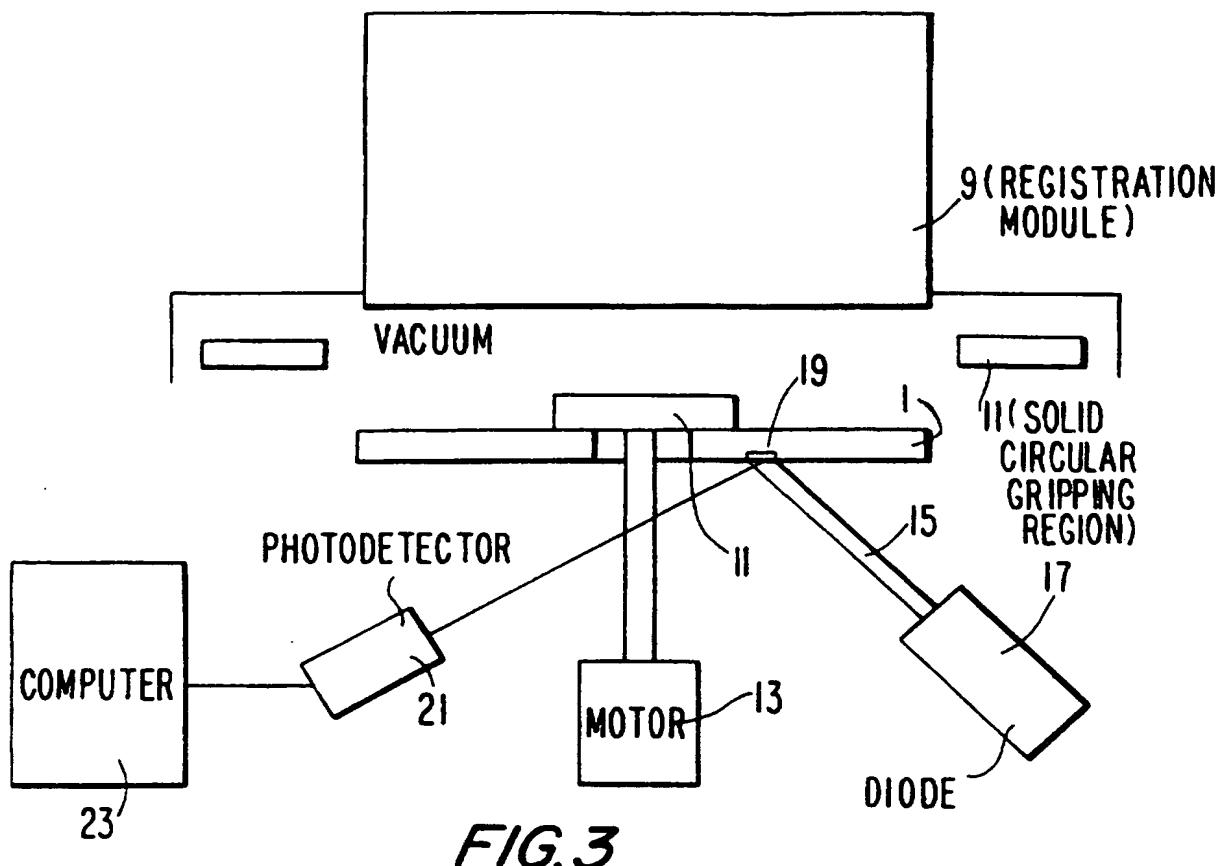
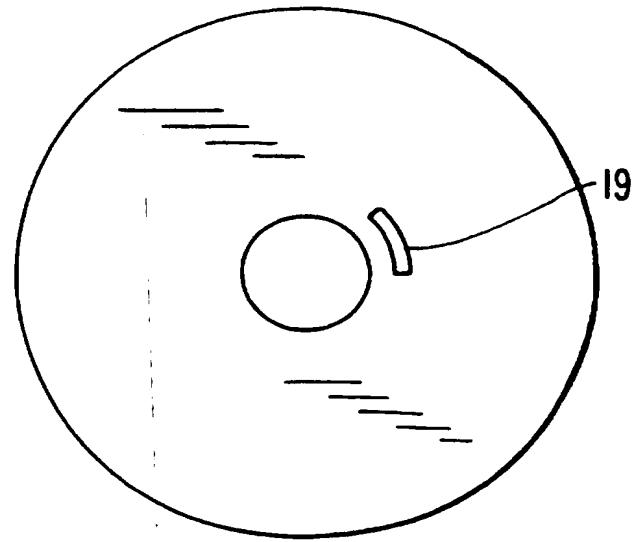


FIG. 3

FIG. 4



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INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB97/01215

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B65G 47/90

US CL :101/485; 414/783

According to International Patent Classification (IPC) or to both national classification and IPC

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Minimum documentation searched (classification system followed by classification symbols)

U.S. : 101/485, DIG. 30; 198/394; 414/783; 901/47

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3,415,350 A (H.W. Murphy) 10 December 1968	NONE
A	US 4,954,044 A (I. Chizaki) 4 September 1990.	NONE
A	US 5,308,222 A (P. Bacchi et al.) 3 May 1994	NONE
A	US 5,429,045 A (W. Karlyn et al.) 4 July 1995	NONE
A	US 5,520,106 A (W. Karlyn et al.) 28 May 1996	NONE

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